Southern Regional Hub-funded project

Project Report

Bring Your Own Device (BYOD) to field class – integrating digital and community mapping in field-based coursework

Preliminary teaching framework for tertiary educators

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UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Research undertaken at the University of Canterbury

Published by Ako Aotearoa

PO Box 756

Wellington 6140

An Ako Aotearoa publication. This project output has been funded by Ako Aotearoa through the Regional Project Fund.

Contents

Overview

Smart device apps are revolutionising how information is recorded outside of the office in all workplaces. Despite the growing utility and availability of apps built for field work, few tertiary classes actively use them to teach skills and increase team building. The objectives of this research project are to investigate the success and challenges of using smart devices in geology and geography field classes. In this document, we provide a preliminary teaching framework for implementing our Bring Your Own Device (BYOD) programme into tertiary field trips. The framework is informed by ~ 1 year of use and student and staff survey data in Geology and Geography classes. Over the course of the next 6 months, a series of video tutorials will be recorded demonstrating each of the elements and additional survey data will be used to gauge the success of this framework. This framework and the resulting videos will be built into a web tutorial aimed towards tertiary educators at the end of 2019. See [Bring Your Own Device (BYOD) to Field Class: Integrating Digital and Community mapping in Field-Based Coursework] for additional project information.

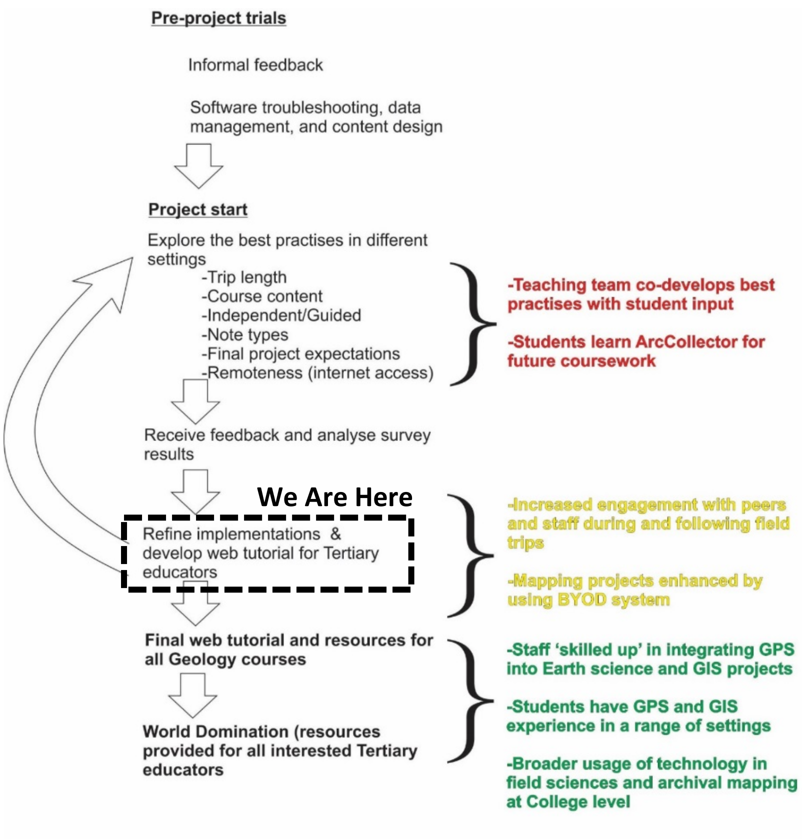


Figure 1: Project Timeline

Context of this Report within Project Timeline

This is a preliminary 'living document' to be revised based on additional survey data over the course of 2019. At this stage (Fig. 1) we have reviewed one round of survey data from three separate courses. Each round of survey data contained a pre- and post-trip survey for staff and students. A few recommendations are based on informal experience in classes that were not surveyed.

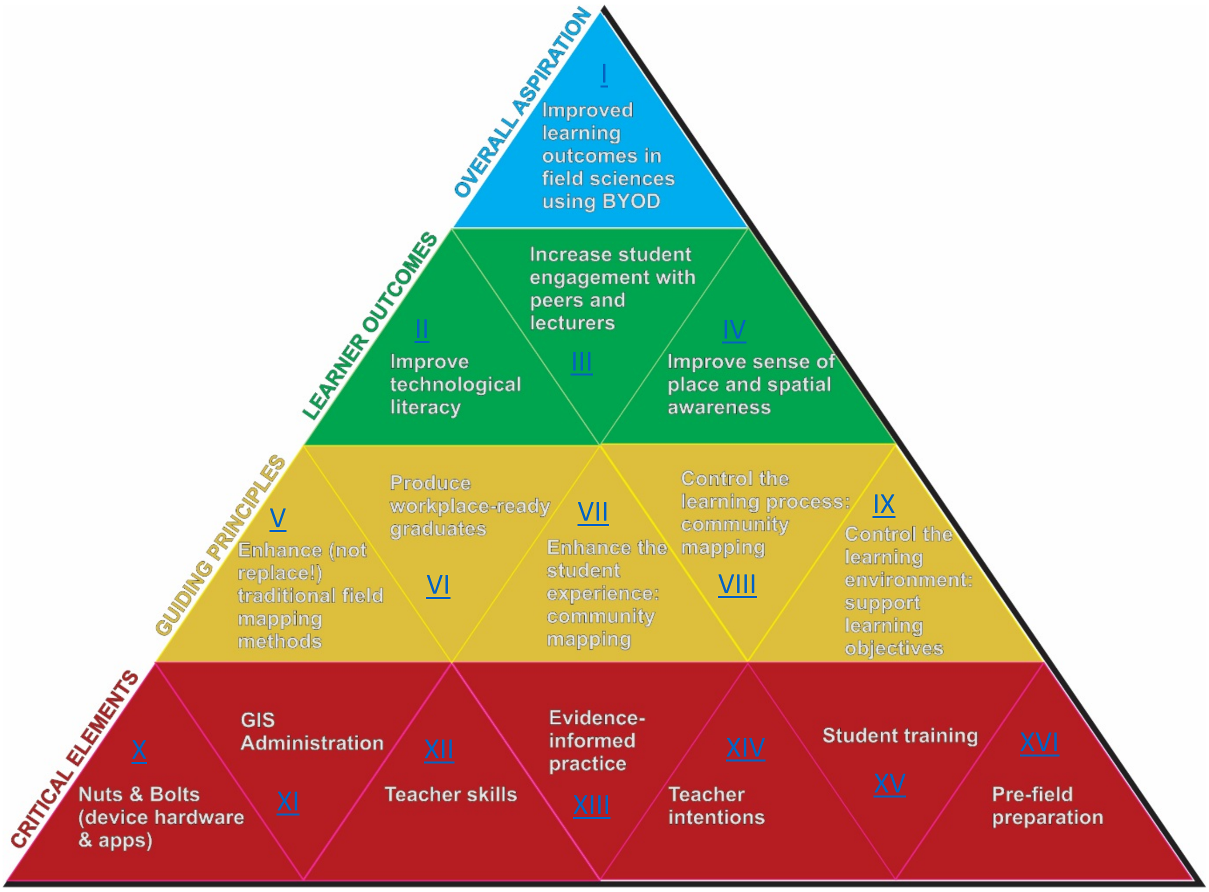


Figure 2: Teaching framework

The BYOD Framework

The purpose of this framework is to inform tertiary educators about best practices for implementing BYOD in field sciences. Our goal is not to provide detailed tutorials of the technology; these are provided by available online resources (under *Critical Elements* section). Our framework (Fig. 2) is modelled after the Ministry of Education's Māori Tertiary Education Framework and follows the *niho taniwha* (tooth of the taniwha) structure to emphasise the interdependence of teeth in the hierarchy. Each tooth contains links (roman numerals) to relevant sections in the remainder of this document.

Overall Aspiration

The workplace is no longer confined to the office, as many careers and curricula now require field work. This is especially true for the sciences (Kent et al., 1997; Smith, 2004; Whitmeyer and Mogt, 2009), where mobile devices are becoming increasingly used for data collection. In field-intensive sciences, digital mapping technologies have revolutionised the ability of field teams and students to interact with each other during field work (e.g., Zook et al., 2010), to collect and archive data from multiple mappers (Whitmeyer et al., 2010; Whitmeyer, 2012), and to create more productive and meaningful shared learning experiences (Cochrane and Bateman, 2010; Pavlis et al., 2010; Whitmeyer and De Paor, 2014). Despite the ubiquity of smart devices and freely available, purpose-built mapping apps, their use in science classes remains limited (Welsh and France, 2012; Pavlis and Mason, 2017). Tertiary educators need to do more to teach using this technology and prepare students for an evolving work place.

Intended Learner Outcomes

At present, this section only describes the pre-trip survey questions we provided to students, and how they map to highest order 'tooth' within the teaching framework. These questions are asked again after the field trip, along with other open-ended and multi-choice questions. This is followed by example survey data from GEOL246 in 2018. As this data is still being collected and yet to be fully analysed, this section will be updated by December 2019.

Pre-trip student survey - Baseline questions only

Please rate the following statements based on your field experience. Circle the answer that most applies to you.

1) I am comfortable using landmarks, topographic maps and/or aerial imagery to identify where I am in the field.

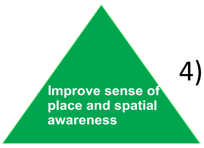
Strongly Disagree　Disagree　Neutral　Agree　Strongly Agree

2) I am confident that I know the important data that I need to collect while in the field.

Strongly Disagree　Disagree　Neutral　Agree　Strongly Agree

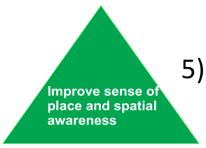
3) I am comfortable using GPS.

Strongly Disagree　Disagree　Neutral　Agree　Strongly Agree



4) I can keep track of everywhere I have been in the field.

Strongly Disagree　Disagree　Neutral　Agree　Strongly Agree



5) I typically remember where all of my field observations came from in the field.

Strongly Disagree　Disagree　Neutral　Agree　Strongly Agree

6) When others talk about what they observed in the field, I find it easy to follow their descriptions.

Increase student engagement with peers and lecturers

Strongly Disagree Disagree Neutral Agree Strongly Agree

Increase student engagement with peers and lecturers

7) I find it interesting to hear and see what others have observed in the field.

Strongly Disagree Disagree Neutral Agree Strongly Agree

Increase student engagement with peers and lecturers

8) I find it easy to communicate what I have observed in the field to others.

Strongly Disagree Disagree Neutral Agree Strongly Agree

Please answer the following questions.

Improve technological literacy

9) Have you used a GPS or smart device (e.g., phone or tablet) for navigation or taking notes before?
    a. Yes
    b. No
10) If the answer to the previous question is ‘yes’, could you explain how you have used it previously (e.g., within this course or other courses, for driving directions, for taking notes, etc.)?

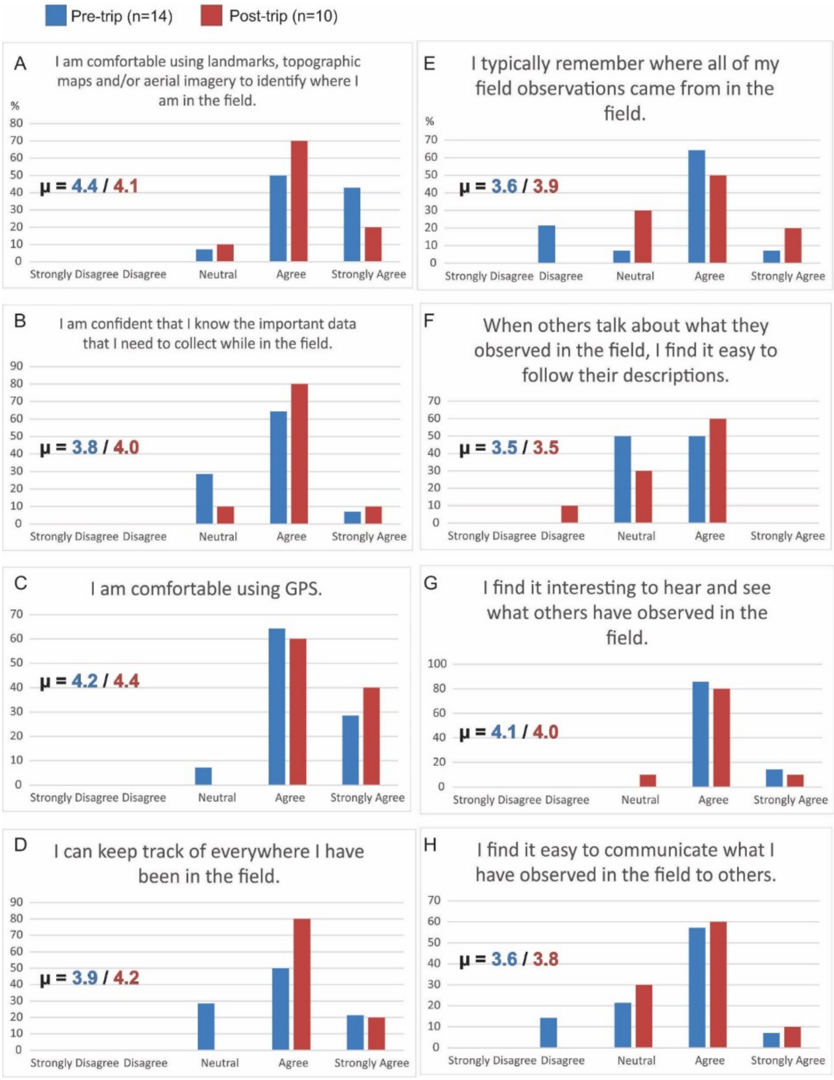


Figure 3: Example survey data from GEOL246

Guiding Principles

Enhance (not replace!) traditional field mapping methods

Background

Preliminary consultation with Geology academics raised the concern that digital mapping would interfere with or detract from tried-and-true mapping skills (e.g., taking notes in a field notebook, drawing geological units on the map, and triangulating your position using landmarks). To address this concern, we chose an app that is not discipline-specific and emphasised to students how and when to use their devices to minimise overlap between traditional and digital media. We included content in the device that reminded students of the key data they were to collect manually, rather than provided the means to do so within the app. Some survey questions targeted whether students felt using their devices detracted or interfered with their field work.

Survey Results

Figures 3A-E address different aspects of this principle in GEOL246, and several write-in comments provided additional feedback:

- “Was very helpful on the GEOL240 trip [for] locating previous outcrops”
- “The app was used to mark locations and outcrops on the downloaded map as well as the ability to add notes and photos which was useful for future reference”
- "I would definitely use a device, being able to find your location accurately on the GPS made finding where we were very easy in places with little landmarks"
- "there wasn't an easy way to take detailed notes on my device through the app"
- “there wasn't an easy way to…relate [notes on my phone] to something I have taken notes on in my notebook"
- "takes some time to enter data, especially in a class setting"
- "wish I could write more"
- "when I returned to my notes after the trip, I realised that I had ignored taking notes in my field notebook"
- "the device was useful for pictures, but useless for notetaking"

Recommendations

- Keep data collection on the device simple: GPS points, Geotagged photos, and limited pre-coded notes are the most successful
- Emphasise where the line is between manual and digital note taking
- Remind students how data stored on the device will be used – is it just for field reference or data analysis later on?

Produce workplace-ready graduates

Background

One of the guiding principles of this project is to prepare students for skills they will need in the workplace. This is part of New Zealand’s Tertiary Education Strategy (“Delivering Skills for Industry”) and the University of Canterbury’s Graduate Attribute Profile (“Employability, innovation, and enterprise”). We envision that this BYOD project addresses these in two ways:

- By providing familiarity with modern data collection techniques, using industry standard software, in a team environment (via ArcGIS and ArcCollector)
- By providing a means for spatial data analysis (via ArcGIS Online)

Survey Results

While most students had some experience with GPS and found the app easy to use, this was in part due to use of the app and training in past courses. Small improvement between pre- and post-trip responses in Fig. 3C indicate that students became more comfortable using GPS over the course of the trip.

Recommendations

- We know that employers and graduates are relying more on technology like GPS for field work – it would be useful to train more skills/tools, by formally consulting employers and using that to tailor the content in ArcCollector
- Use the data stored in ArcCollector to sync to ArcGIS Online: allow the students to work with the wealth of data in the classroom, especially with quantitative data.

Enhance the student experience: community mapping

Background

Field trips are most effective when they are fun and provide a *sense of place* to students (Jolley et al., 2018). The latter can be difficult in large field areas or field trips consisting of multiple, disconnected, and/or roadside stops. This app provides a fun, easy, visual method to (i) keep track of the regional context of the fieldwork, (ii) encourage a sense of exploration, (iii) foster an in-field instructor-student learning community (e.g. Jolley et al., 2018).

Recommendations

- Provide maps and layers in the app that provide students regional context
- Provide layers that provide students cultural and historical context
- Encourage all students, demonstrators, and lecturers to use BYOD – requires buy-in from staff

Control the learning process: community mapping

Background

Peer teaching is an effective tool in any environment. Because students have the opportunity to sync their data to master datasets in ArcCollector, the entire class is privy to a wealth of peer data and observations. The app also makes it easy to share the location of geotagged photos and videos on the fly (i.e. without syncing data).

Survey Results

Figure 3F-H displays the results of questions targeting this issue in GEOL246. There was no substantial improvement or deterioration in how students perceived their interaction with others. Other anecdotal evidence suggests that this may not be the case:

- Two students who could not attend the one-day field trip were able to watch geotagged videos of lectures and follow sync'd peer data of the trip. Some students found it useful to review peer data and lectures in ArcGIS online despite having attended on the day.
- In GEOl240, some staff stated they observed students discussing their mapping and planned routes using the ArcCollector app, both with demonstrators and other students.

Recommendations

- Lecturers should model behaviour of using the app to discuss existing data and mapping strategies
- The app and online interface (ArcGIS Online) can be used as field trip review upon trip conclusion

Control the learning environment: support learning objectives

Background

Smart devices can be used to reinforce existing learning objectives for students. For example, one of the major challenges in field geology classes is overcoming a steep learning curve of recalling all of the new types of data you are required to collect at every outcrop: location, rock type, sedimentary structures, orientation of bedding, weathering characteristics, contacts, foliation, etc. This can be overwhelming for students, especially in the context of having limited time for a first-time mapping assignment.

One successful approach was providing students a drop-down menu of the key data they had to collect at each site. In geology, we encourage students to collect the actual data in field notebooks, but 'digital reminders' stored within the app can be a useful strategy.

Having digital content stored within the app also presents the opportunity to provide students with multiple layers of GIS information. In geology, this means that while students are mapping on aerial photos of an area, they can check their location against other basemaps (e.g. topographic maps, hillshade models, existing geologic maps), GIS features (e.g., land use and property boundaries, fences, cultural landmarks), and other student data. In cases where the local geology directly influences things like vegetation, or locations of springs, for example, these datasets provide meaningful insights into 'why geology matters'.

Recommendations

- Provide 'digital reminders' stored within the app to support learning objectives
- Provide a range of interdisciplinary GIS data to give context to the science

Critical Elements

X. Nuts & Bolts (device hardware & apps)

We considered a range of apps to use in this project. We settled on the ArcCollector app because it is versatile and customisable for a range of uses outside of purpose-built Geology apps, for example. ESRI has an overview of the hardware requirements along with other resources & tutorials for this app here.

Nicolas Barth of University of California Riverside has an excellent review of different software/hardware combinations for field mapping if there is interest in using other systems.

Because this is a BYOD programme, there is the risk of being exclusive to students who do not have devices or compatible devices. We are in the process of purchasing field-ready iPads for students who cannot bring their own devices, for mapping groups who prefer a shared tablet medium, and lecturers/demonstrators. In general, mapping in groups can combat the risk of being exclusive, as most students prefer and are willing to bring their own devices.

XI. GIS Administration

This system requires an organisational account with ArcGIS Online and, in part, on available credits for hosting content online. We expect most Tertiary institutions with a geology or geography programme will have this. In our case, we also have a GIS administrator and technicians that perform the following functions, allowing the field work to run smoothly:

- Manages students' accounts for each course (e.g., adding/deleting from course, managing access)
- Technical support for interface between ArcGIS Online and ArcCollector
- Teaching support for student training

These functions can be performed by teaching staff, but are time-intensive and more appropriately dealt with by a GIS specialist/technician.

XII. Teacher Skills

Teachers need to know how the app works, common errors and faults, and how to prepare all of the content used in the app, and how to download and manage all of the data that is collected. This requires a non-trivial amount of time and training. Fortunately, ArcGIS provides useful resources for both upstream (ArcGIS and ArcGIS Online) and downstream (app) components (see Section X).

XIII. Evidence-informed practice

This document forms one basis for evidence-informed practice, but we encourage educators to constantly monitor and adjust based on (i) feedback from students and/or (ii) user data preserved in

ArcGIS online. How are the students using the content provided to them? How many individuals contributed to the group 'sync'd' data? Did they find the field data useful?

XIV. Teacher intentions

Teachers need to spend time planning how this BYOD programme will be constructively aligned in the curriculum. Is this just a novelty, or another tool-of-the-trade? Can it build on concepts explored later in class? How will the data be used? How does the app content help the student learn?

XV. Student training

Some training is critical to the success of BYOD. Students need to know how to log in to ArcCollector, download data and map areas, and collect/delete/sync features. If this is left until being in the field, cognitive overload will be too much and students will tune out.

One idea that has been successful in Geology courses is the 'scavenger hunt' model of training, built into an orienteering training exercise. In this exercise, students were provided content on the app that indicated the locations of checkpoints around the university campus. Students navigated to these positions using their devices, collected a geotagged photo of them collecting the 'reward', collected a basic GPS point and description of the site, then synced the data in real time back to the instructor in the classroom.

One additional note: students strongly prefer bringing their own device over using someone else's. The relevant survey data (from GEOL246) are compiled below:

- 8 out of 10 respondents on the post-trip survey (80%) used their own device; 2 relied on someone else's device
- When asked about drawbacks to BYOD, one respondent said:

  "maybe people borrowing your own device to help locate themselves and having to pass it around"

  Two respondents said there were no drawbacks

- When asked if they preferred to use their own device, someone else's or none:

  "I liked using my device because it gave me a clear idea as to where my images were along the trip"

  "my own-for reasons of familiarity"

  "own device-it is useful to have no admin in accessing the data collected"

  "my own- I'd prefer not to sync data to prevent over-clustering field data"

  "own-easy to follow and update later on"

  "own device: familiar setup and easier to access data later on"

  "my own- I know how it works, less things to carry"

  "my own so I could refer back to info more easily"

  "my own device as that'll be the easiest to translate data"

XVI. Pre-field preparation

This is partially linked to the two previous elements, but with a more practical note: ensure that students download content to their devices and collect ‘dummy’ data prior to going into the field. Educators need to allow time to fix student and software errors, which are common.

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